COMBUSTION APPARATUS FOR TREATING DRY DISTILLATION GAS

TECHNICAL FIELD

The present invention relates to a combustion apparatus for combusting and treating dry distillation gas generated during a waste treatment by means of dry distillation.

BACKGROUND ART

A waste treatment system comprising a combustion apparatus for treating waste by means of dry distillation in a pyrolysis furnace, with which dry distillation gas generated during the waste treatment is burnt for detoxification and resultant heat is extracted for recycling, is disclosed in patent document 1 filed by the applicant of the present application. (Japanese published patent application No.2001-108210)

The waste treatment system disclosed in said patent document comprises a pyrolysis furnace, an inert gas generator, and a generated gas treatment device. Dry distillation residue caused by the dry distillation treatment of waste in the pyrolysis furnace is transferred to the inert gas generator and inert gas generated from the dry distillation residue is returned to the pyrolysis furnace. The dry distillation gas generated during the waste treatment by means of the dry distillation is burnt in the generated gas treatment device to be extracted as heat for recycling, or if the generated gas is high in heat quantity, to be reformed and recovered as oil.

The dry distillation gas is less susceptible to dust contamination than combustion gas generated by incineration of waste, and thus it is beneficial in that combustion atmosphere can be maintained at high temperature while at the same time a level of exhaust gas can be kept low. The waste treatment by means of dry distillation is thus more advantageous than ordinary incineration treatment in the areas of exhaust gas detoxification and thermal recycling.

This type of waste treatment apparatus is required to be equipped with a means of preventing a fire and an explosion.

Conventionally, multiple nozzles with small diameter are bundled to act as a porous nozzle and used for burning the dry distillation gas. Combustion air is infused from the circumference space of each nozzle into the combustion chamber so that it mixes with the dry distillation gas and increases combustion temperature. With this arrangement, backfiring can

be prevented by using the nozzles with small diameter.

Disadvantageously, however, the dry distillation gas can still get contaminated with a small amount of dust resulting from treating various types of waste and such dust would problematically block feed openings. It is ineffectual to simply enlarge the apertures of the porous nozzle in order to solve this problem, since it would cause backfiring that would blow back through the feed openings to the pyrolysis furnace and set off an explosion.

Also disadvantageously, a flow volume and a flow rate of the dry distillation gas may change at intake openings and the feed openings where a flow channel of the dry distillation gas varies in width and direction, thus the dust contained in the dry distillation gas would become solated and remain on the wall.

The solated material accumulated over an extended time period of continuous running of the apparatus becomes solid as time progresses, making it difficult to be removed. This can result in defects such as blocking of the feed openings, which consequently causes turbulent flow of the dry distillation gas to be supplied to the combustion chamber.

Still disadvantageously, an amount of the dry distillation gas to be supplied to the combustion chamber widely fluctuates, because of irregular generation of the dry distillation gas as a result of treating a mixture of various wastes. The flow rate of the dry distillation gas thus becomes turbulent, which could result in backfiring.

SUMMARY OF THE INVENTION

The present invention intends to provide an improved combustion apparatus with a low risk of a fire and an explosion, in which a nozzle is prevented from being blocked with dust contained in dry distillation gas so that backfiring would not be caused.

In order to achieve this objective, a combustion apparatus for treating dry distillation gas as defined in claim 1 comprises: a gas pipe for supplying a combustion chamber with dry distillation gas generated during a waste treatment by means of dry distillation; an air pipe for supplying a front edge of said gas pipe with combustion air; and a combustion nozzle formed at said front edge of said gas pipe; wherein, said air pipe is centrally placed inside said gas pipe so as to construct a coaxial double pipe, and said combustion nozzle is formed as a circular combustion nozzle at said front edge of said gas pipe.

In the combustion apparatus for treating dry distillation gas as defined in claim 2, said air pipe is supported to be axially rotatable, and scrapers are further provided with blades of said scrapers being in contact with a circumference surface of said air pipe.

In the combustion apparatus for treating dry distillation gas as defined in claim 3, an inner circumferential surface of said front edge of said gas pipe is beveled inward at predetermined angle to form a narrowed portion, and said air pipe is supported to be movable back-and-forth relative to said narrowed portion.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 is a side view of a combustion apparatus for treating dry distillation gas according to the present invention. Fig.2 is a partially sectional plain view of the combustion apparatus for treating dry distillation gas according to the present invention. Fig.3 is a sectional view of Fig.2 along the line F-F. Fig.4 is a sectional view of Fig.2 along the line A-A. Fig.5 is a sectional view of Fig.2 along the line C-C. Fig 6 is a sectional view of Fig.5 along the line B-B. Fig.7 is a sectional view of Fig.2 along the line D-D. Fig.8 is a partially enlarged view of Fig.2. Fig.9 is a side view of a back-and-forth shifting apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention would be better understood when explained with references to the attached drawings. Fig.1 is a side view of a combustion apparatus for treating dry distillation gas 1 according to the present invention, and Fig.2 is a partially sectional plain view of the combustion apparatus for treating dry distillation gas 1.

The combustion apparatus for treating dry distillation gas 1 consists of a gas feeding unit 3 and an air feeding unit 4 with an air pipe 5 running through both the feeding units.

The gas feeding unit 3 is comprised of a gas pipe 30 and a gas feeding tower 31. The air pipe 5 is placed inside the gas pipe 30 in order to form a coaxial double pipe, which is inserted into a combustion chamber 20 to form a combustion nozzle.

The air feeding unit 4 comprises an outer cylinder 40, to which an air feeding tower 43 is jointed. The air feeding unit 4 is located so as that it shields air feeding apertures 50 made on the air pipe 5.

A fixed base 10 and a movable base 11 facing each other are placed underneath the rear section of the air pipe 5. The movable base 11 is slidably connected to the fixed base 10 via a back-and-forth shifting apparatus 6.

A support frame 12 and a set of four support rollers 13 are provided at each end of the movable base 11. As shown in Fig.3, the rotatable support rollers 13 mounted on the support frame 12 hold a roller guide 14 that is provided on the air pipe 5.

Fig.4 further shows a motor 15 mounted on the movable base 11 and a guide 51 provided around the air pipe 5, between which a transmission means 16 such as a heat-proof belt is rolled over to allow the air pipe 5 to rotate.

Fig.5 is a sectional view of the gas feeding unit 3 along the line C-C and Fig.6 is a sectional view of the gas feeding tower 31 along the line B-B.

The gas feeding unit 3 is constructed with the gas feeding tower 31 being jointed on the circumference of the gas pipe 30. The gas pipe 30 is inserted into a nozzle inserting port 21 of a combustion furnace 2. A circular gap A is formed between the gas pipe 30 and the air pipe 5 coaxially placed in the gas pipe 30.

Dry distillation gas is supplied from the gas feeding tower 31 and runs through a cylindrical gap between the gas pipe 30 and the air pipe 5 to be finally infused into the combustion chamber 20 from the circular gap A at the front edge of the gas pipe 30.

A risk of backfiring can be decreased by elongating a distance between the gas feeding tower 31 and the front edge of the gas pipe 30, since the dry distillation gas infused from the circular gap A would be more stable as said distance gets longer than it is actually required depending on gas density or flow resistance rate.

Finders 35 are mounted on the circumference of the gas pipe 30 with an angle relative to a tangent for the purpose of viewing a state of dust adhering. The gas feeding tower 31 is also provided with the finders 35. The finders 35 may be equipped with cleaning nozzles for cleaning a pipe wall in the dry distillation gas atmosphere.

A pair of scrapers 33 is supported by a supporting member 32 built in the gas feeding tower 31 and blades of the scrapers 33 are in contact with the circumference of the air pipe 5. The scrapers 33 are positioned so as that they are double-tiered but without having scraping areas overlap each other. As the air pipe 5 rotates, the dust accumulated on the circumference

of the air pipe 5 can be scraped off.

A tank B equipped with a seal damper 34 is located on the lower side of the gas feeding tower 31. In an embodiment illustrated in Figs.5 and 6, a sliding seal damper 34 is used for sealing the tank B from the gas feeding tower 31 that is under the dry distillation gas atmosphere. The tank B is further provided with a vent. As the tank B can be sealed off with the seal damper 34, scraped dust pieces in the tank B can be regularly taken out from the vent even when the combustion chamber is running. The seal damper 34 can take forms other than sliding type, such as a butterfly type.

Fig.7 is a sectional view of the air feeding unit 4 along the line D-D. The air feeding unit 4 comprises the outer cylinder 40 and the air feeding tower 43. The outer cylinder 40 is sectioned into an upper outer cylinder 41 and a lower outer cylinder 42, and the air feeding tower 43 is integrally connected to the lower outer cylinder 42. The air pipe 5 has the air feeding apertures 50, which are dividing the circumference of the air pipe 5 into 5 segments in the embodiment of Fig.5. The upper outer cylinder 41 and the lower outer cylinder 42 are jointed together to cover said air feeding apertures 50.

Combustion air is supplied from the air feeding tower 43 and passes through the air feeding apertures 50 to enter into the air pipe 5. The combustion air then runs through the air pipe 5 and is eventually delivered into the combustion chamber 20 via an air feeding port 52.

The combustion air and the dry distillation gas are thus blended to be burnt together, and generate an inert gas such as carbon dioxide.

Fig. 8 is a partially sectional plain view of a nozzle.

The aforesaid gas pipe has its front inner circumference beveled inward to form a narrowed portion. In the illustrated embodiment, a corner of the combustion chamber at the nozzle inserting inlet 21 is alternatively formed with an angle α, but the gas pipe 30 may instead be formed with an angle at its front edge to form the narrowed portion. The air pipe 5 also has its front edge beveled inward with an angle β, which is smaller than the angle α. The opening width of the circular gap A can be adjusted by these angles α and β together with the back-and-forth shifting apparatus 6, whose details will be explained later.

In the gas feeding unit 3, a packing stopper 36 is provided on the inner wall of the gas pipe 30. A packing 38 is impregnated with a substance such as carbon so that it achieves heat

resistance along with decay resistance, and is fitted into the circular gap A. The packing 38 is then pressed with a presser flange to be bonded by pressure.

Also in the air feeding unit 4, the packing 38 is used for sealing a jointed region of the upper outer cylinder 41 and the lower outer cylinder 42 as well as a contact site of the air pipe 5 and the outer cylinder 40 so as to form a so called "swivel" structure.

The dry distillation gas and the combustion air would not only contain toxic components, but also they could reach a very high temperature. It is therefore necessary that areas being under the dry distillation gas atmosphere or the combustion air atmosphere be blocked from outside air by means such as the packing 38. The dry distillation gas and the combustion air in fact reach a few hundreds degrees C in temperature, and thus the belt used as the transmission means 16 and the packing 38 need to be provided with sufficient heat resistance and decay resistance.

Fig.9 is a side view of the back-and-forth shifting apparatus 6.

The back-and-forth shifting apparatus 6 has a handled screw shaft 60. The movable base 11 can be moved back-and-forth relative to the fixed base by turning the handled screw shaft 60. This back-and-forth movement is transmitted via the support rollers 13 and shifts the air pipe 5 back-and-forth as well, thereby adjusting the opening width of the circular combustion nozzle.

The present invention constructed as described above will operate as follows.

The dry distillation gas is supplied from the gas feeding unit 3 and runs through a cylindrical gap between the gas pipe 30 and the air pipe 5 to be finally infused into the combustion chamber 20 from the circular gap A at the front edge of the gas pipe 30.

The combustion air is supplied from the air feeding tower 43 and passes through the air feeding apertures 50 to enter into the air pipe 5. The combustion air then runs through the air pipe 5 and is eventually delivered into the combustion chamber 20 via an air feeding port 52, where the combustion air and the dry distillation gas are blended and burnt together.

The amount of the dry distillation gas to be generated would largely fluctuate depending on types and conditions of waste, but the amount of the dry distillation gas to be supplied can be stabilized by adjusting the width of the circular gap A with the aid of the angle α and β given at the front edge of the gas pipe 30 together with the back-and-forth shifting

apparatus 6.

The finders 35 are mounted on the circumference of the gas pipe 30, enabling viewing of the pipe wall to which the dust contained in the dry distillation gas would adhere. The finders 35 may be equipped with the cleaning nozzles so that the pipe wall under the dry distillation gas atmosphere can be cleaned when the combustion apparatus is not in operation. At the same time, however, the present invention is arranged with the scrapers 33 being in contact with the circumference of the air pipe 5 that is rotatably supported by way of the support rollers 13 mounted on the movable base 11, the motor 15, and the transmission means 16, and therefore the dust accumulated on the pipe wall of the air pipe 5 can be scrapped off even while the dry distillation treatment is being operated.

The dust so scraped from the pipe wall are dropped in the tank B that is located on the lower side of the gas feeding tower 31, and can be regularly or continuously taken out therefrom.

The combustion air as previously described may be replaced by high-temperature steam. When the dry distillation gas is exposed to the high-temperature steam, it becomes separated and generates inert gas such as carbon dioxide, thereby producing the identical effects of the combustion air. Even advantageously, the volume of the gas to be finally exhausted can be significantly reduced, since the high-temperature steam does not contain nitrogen.

INDUSTRIAL APPLICABILITY

As defined in claim 1, the present invention is constructed in a double pipe structure so that it forms the circular combustion nozzle, thereby achieving the feed opening for the dry distillation gas with sufficient width. With this arrangement, a large amount of the dry distillation gas can be evenly supplied and a blockage of the feed opening with dust pieces can be prevented, thereby lowering a danger of backfiring.

As defined in claim 2, the present invention is constructed with the rotatable air pipe and the scrapers, with which the dust accumulated on the pipe wall can be scraped off while the apparatus is continuously being in operation. With this arrangement, the dry distillation gas can be stably supplied from the feed opening without any turbulence, thereby preventing backfiring.

As defined in claim 3, the present invention is constructed with the air pipe that is movable back-and-forth so that the width of the circular combustion nozzle can be adjusted in proportion to the amount of the generated dry distillation gas. With this arrangement, the dry distillation gas can be supplied from the feed opening at a constant flow volume and a flow rate, thereby preventing backfiring.